

NON-PUBLIC?: N
ACCESSION #: 8906050380
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Arkansas Nuclear One, Unit One PAGE: 1 of 5

DOCKET NUMBER: 05000313

TITLE: Reactor Trip Due to Personnel-Induced Vibration of an Inadequately
Supported Turbine Control Panel
EVENT DATE: 05/01/89 LER #: 89-018-00 REPORT DATE: 05/31/89

OPERATING MODE: N POWER LEVEL: 050

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECT
ON
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Julie D. Jacks, Nuclear Safety and TELEPHONE: 501-964-3100
Licensing Specialist

COMPONENT FAILURE DESCRIPTION:
CAUSE: D SYSTEM: JK COMPONENT: 83 MANUFACTURER: D006
REPORTABLE TO NPRDS: Y

CAUSE: A SYSTEM: SB COMPONENT: RV MANUFACTURER: D243
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On May 1, 1989, the reactor tripped on a turbine trip caused by maintenance personnel inadvertently jarring a turbine control panel containing Mercoid switches for turbine trip functions. Maintenance personnel had gone inside the main turbine housing to replace an electro-hydraulic fluid filter for a turbine throttle valve. As personnel exited the work area by climbing down from a catwalk to the top of a ladder approximately five feet below, the control panel was being used as an intermediate stepping place without incident. However, at 1556 hours, the unit tripped when switches for the turbine solenoid trip function changed state as the panel was stepped on. Following the trip, Main Feedwater Pump P1B failed to run back to minimum speed due to control air pressure buildup in an isolated sensing line in the control system. Also, a Main Steam Safety Valve (MSSV) failed to completely

reseat after lifting due to a missing cotter pin. The missing pin allowed a nut to vibrate down the valve stem while the valve was relieving steam, preventing the valve from fully closing. The turbine control panel has been labeled with a caution that it is a unit trip hazard. The isolated sensing line has been unisolated. The MSSV missing cotter pin was replaced and cotter pins were verified installed on the other MSSV.

END OF ABSTRACT

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A. Plant Status

At the time this event occurred, Arkansas Nuclear One, Unit One (ANO-1) was operating at 50 percent of full power. Reactor Coolant System (RCS) (As) temperature was 579 degrees Fahrenheit and RCS pressure was 2155 psig.

B. Event Description

On May 1, 1989, mechanical maintenance personnel had entered the housing of the High Pressure Main Turbine TA! to replace a filter for the electro-hydraulic (EH) fluid which controls mainturbine steam supply throttle valve CV-6629. The four throttle valves are designed to be fully open after startup of the main turbine, and the steam supply to the turbine is controlled by the four governor valves during operations. Throttle valve CV-6629 had closed several times in the days preceding this event and the EN fluid filter was being replaced in an effort to resolve this concern, even though operation of the plant was not affected by the throttle valve closing due to the crossover arrangement of the steam supply piping.

The inside of the HP turbine housing is designated a radiologically controlled area due to the presence of contaminated insulation on the HP turbine. (The contamination was caused by a steam generator tube leak in a previous cycle.) The work area next to the throttle valve was within the controlled area, which required the mechanics to don protective clothing and follow the health physics procedures for entering and exiting the work space. Based on routine operator duties, the step-off pad for the area had been previously positioned next to a short ladder near a south door in the turbine housing and was not repositioned for this specific job. The filter replacement was performed from a catwalk approximately five feet above the top of the ladder. Maintenance personnel had accessed the catwalk using a ladder installed for that purpose at the north end of the catwalk; however, health physics procedures required them to exit the area at the step-off pad at the south end of the catwalk. Thus the maintenance personnel had to egress the work space after replacing the filter by climbing down from the catwalk to the top of the short ladder. A natural intermediate step in this climb down was a control panel which

contained the Mercoid switches for the main turbine solenoid trip function. The panel was not labeled as a unit trip hazard. Personnel had previously exited the area without incident. However, at 1556 hours, when a mechanic stepped on the control panel, the vibration caused at least four of the Mercoid switches to change state, including PS-8550, the auto-stop oil pressure switch. When this switch made up, solenoid valve SV-8527 received an open signal which tripped the turbine by dumping the turbine high pressure EH fluid, closing the turbine throttle valves and governor valves. The turbine trip caused anticipatory reactor trip of the Reactor Protection System (RPS) JC! on a main turbine trip when reactor power is greater than 43 percent.

Following the reactor trip, Main Feedwater Pump P1B SJ-P! failed to run back to minimum speed. The pump continued to run at approximately its previous speed until high discharge pressure tripped the pump at 1602 hours. The high discharge pressure was caused by the normal post-trip closure of the main feedwater valves and by having the recirculation valve for P1B isolated due to leakage past the valve.

At 1615 hours, operators determined that Main Steam Safety Valve (MSSV) PSV-2688 SB-RV! had failed to completely reseal following the reactor trip. The MSSV is located on the steam header for the 'B' Once-Through Steam Generator (OTSG). The operators attempted to close the MSSV by opening the turbine bypass valve for the affected steam header and lowering pressure in the OTSG. During the next 30 minutes, four attempts were made to reseal the valve by incrementally lowering OTSG pressure, eventually dropping the pressure to a minimum value of 793 psig. The partially open MSSV had no discernible affect on RCS temperature. Efforts to reseal the valve by lowering OTSG pressure caused RCS temperature to drop to a minimum of 540 degrees. Normal post-trip temperature is 545 degrees.

Operators requested assistance from maintenance personnel to reseal the MSSV. When the valve cover was removed, a cotter pin was found to be missing from the stem nut. The missing cotter pin allowed the nut to vibrate down the valve stem while the MSSV was lifting and prevented the MSSV from completely resealing. The stem nut functions as a leverage point for the manual operating lever and is held in place on the valve stem by the cotter pin. Mechanical maintenance personnel rotated the stem nut back up the stem and the MSSV was reseated at 1740 hours.

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C. Safety Significance

The Reactor Protection System functioned as designed to automatically trip the reactor if the turbine trips when reactor power is greater than 43 percent of full power. No other Engineered Safeguards Features were required or

actuated.

The failure of P1B to run back to minimum speed did not affect Reactor Coolant temperature or pressure as the main feedwater valves functioned properly to control feedwater flow to 'B' OTSG. When P1B tripped, the feedwater crossover valve opened automatically as designed and Main Feedwater Pump P1A supplied both OTSGs as necessary.

The failure of PSV-2688 to reseal completely did not affect RCS temperature or pressure. Attempts to reseal the valve by lowering 'B' OTSG pressure resulted in an RCS temperature drop of only a few degrees below the normal post-trip temperature.

D. Root Cause

The root cause of the event was determined to be the fact that there was no label on the control panel to caution personnel regarding its potential impact on plant availability. This lack of identification of sensitive equipment resulted in the job planner not identifying the need for caution to the maintenance personnel and maintenance personnel not realizing the possible consequences of stepping on the turbine control panel. Health physics personnel also did not recognize the concern with locating the step-off pad at the ladder next to the control panel. The radiological controls for this area had been established previously and were based on routine operator duties, not on the specific task of working on the throttle valve.

The P1B Main Feedwater Pump failed to run back to minimum speed due to air pressure built up in an isolated sensing line upstream of the 'B' pneumatic high-select relay JK-83!, located in the feedwater control system supplied by Lovejoy Controls Corporation. Gradual back leakage was later determined to be a normal characteristic of the Dahl pneumatic high-select relays in the control system. This back leakage across the 'B' high-select relay allowed control air pressure to buildup in the line between the 'B' relay and a closed manual isolation valve for the manual control air regulator (see Figure 1). When the reactor tripped, the signal being passed from the 'A' high-select relay to the 'B' high-select relay dropped to its minimum value to run the prop back to minimum speed. However, normal operating pressure was still in the other sensing line feeding the 'B' relay, and the higher signal was passed to the Speed Changer Valves. Therefore, P1B speed was not reduced when the reactor tripped. The root cause of the pressure buildup in the sensing line was the closed position of the manual isolation valve, which was closed in accordance with the applicable operations procedure. If the valve had been open, the pressure in the line would have been relieved through the bleed port on the manual regulator. A technical data notice from Lovejoy Controls Corporation dated 5/1/87 recommended leaving the isolation valve open during operations; however, this notice was apparently not received at ANO-1.

The root cause for the missing cotter pin from PSV-2688 could not be verified, but personnel error is most likely. Testing was performed on the MSSV during the previous refueling outage. The testing procedure contains a step which instructs that the cotter pin be reinstalled, but the step does not require initials or a check to document completion of the step.

E. Basis for Reportability

This event resulted in an automatic actuation of the RPS and is therefore reportable in accordance with 10CFR50.73(a)(2)(iv).

The NRC Operations Center was notified of this event at 1630 hours on May 1, 1989, in accordance with 10CFR50.72(b)(2)(ii).

F. Corrective Actions

A warning placard has been installed on the turbine control panel which cautions personnel that the panel is a unit trip hazard.

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The manual isolation valve in the main feedwater pump pneumatic control system is now open, and the Operations procedure for the control system has been changed to require the manual regulator to be unisolated for both P1A and P1B. A pressure gauge has been temporarily installed to monitor air pressure in the line between the 'B' high-select relay and the manual isolation valve. The 'B' pneumatic high-select relay in the Lovejoy control system for P1B was replaced as its operability was initially questioned. A Badger speed changer valve in the Lovejoy control system was also replaced. The Badger valve regulates the control oil pressure based on the pneumatic signal supplied by the 'B' high-select module. The removed valve was returned to Lovejoy Controls Corporation for testing; no operational difficulties were found.

The missing cotter pin on PSV-2688 was replaced and the other MSSVs were checked to verify that the cotter pins were in place. The maintenance procedure for testing the MSSVs will be revised to require initials verifying replacement of the pin.

G. Additional Information

A previous reactor trip followed by the failure of P1B to run back to minimum speed was reported in Licensee Event Report 50-313/89-002-00.

Energy Industry Identification System (EIIS) codes are identified in the text as XX!.

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FIGURE OMITTED - NOT KEYABLE (DRAWING)

Figure 1

Pneumatic Portion of Main Feedwater Pump Turbine

Lovejoy Control System

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ARKANSAS POWER & LIGHT COMPANY

May 31, 1989

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U.S.Nuclear Regulatory Commission
Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

SUBJECT: Arkansas Nuclear One - Unit 1
Docket No. 50-313
License No. DPR-51
Licensee Event Report No.50-313/89-018-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(iv), attached is the subject report concerning a reactor trip due to a turbine trip which was inadvertently caused by personnel-induced vibration of an inadequately supported turbine control panel.

Very truly yours,

E.C.Ewing
General Manager,
Plant Support

ECE: JDJ: sgw
attachment

cc w/att: Regional Administrator

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